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Modification of Ntezi Bentonite Structure by Hydrochloric Acid: Process Kinetics and Structural Properties of the Modified Samples

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(received September 17, 2012; revised November 29, 2012; accepted December 5, 2012)

Abstract. Bentonite from Ntezi was modified by reacting it with different concentrations of hydrochloric acid solutions. The modified samples were analysed by x-ray fluorescence. The kinetics of the modification reaction was studied by performing the experiment at different temperatures and times. Results of the analysis of the modified samples showed that the octahedral cations were removed which altered the chemical composition of the bentonite. The surface area and adsorptive capacity of the bentonite were improved after the modification. The kinetic studies showed that the acid modification reaction is controlled by the product layer diffusion and can be represented by $[1-(1-X)^{1/3}]^2 = k t$; where, X is the fraction of the bentonite dissolved at time t. The activation energy was determined to be 24.98 kJ/mol.

Keywords: adsorption, bleaching, activation, kinetic model, chemical treatment, bentonite

Analysis and Appraisal of Urban Road Traffic Noise of the City of Cuttack, India

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(received February 21, 2012; revised December 31, 2012; accepted January 7, 2013)

Abstract. The road traffic noise environment in the Cuttack city, commercial and judicial capital of the Indian state, Odisha, has been appraised in the present study. Noise pollution was analysed in 17 different squares (road sections) during four different specified times to assess the level of noise pollution of the city. Noise descriptors such as L_{10} , L_{50} , L_{90} , L_{eq} , TNI (traffic noise index), NPL (noise pollution level), NC (noise climate), Q (traffic volume) and P (truck-traffic mix ratio) were analysed to reveal the extent of noise pollution due to heavy traffic in this city. A systematic comparison between TNI and L_{eq} noise levels for all selected locations reveal that the TNI values are much more than respective L_{eq} levels. This simply demonstrates that although the noise levels during any period of the day are generally constant but the presence of single event noise is sufficient to affect the values of L_{10} , L_{50} , L_{90} , L_{eq} and consequently the TNI. Analysis of variance (F-test) is also computed for investigated squares to infer the level of significance. Even the minimum NPL and TNI values are more than 100 dB. Noise levels at all the road sections exceeded the standard ambient noise levels prescribed by WHO (70 dB).

Keywords: community response, Cuttack city, noise descriptors, traffic noise, traffic volume

Depositional Environments of the Bara Formation Sandstone From Lakhra Areas Sindh, Pakistan

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(received January 3, 2012; revised February 19, 2013; accepted February 21, 2013)

Abstract. Twenty four samples of the Bara formation from east and west sections of Lakhra areas have been investigated, to interpret the environments of deposition and to propose a suitable classification for the sandstones present in the studied sediments. Values of different statistical parameters of the studied sediments grain size data, for example mean, median; standard deviation, skewness, and kurtosis were determined for plotting the cumulative curves and histograms to analyse the data. Study of the shapes, roundness and the sphericity of the grains provided valuable information regarding the environment of deposition. The 92 percentage negative and 8 percentage positive values of skewness, respectively, indicated that the studied sediments are composed of coarse grained-fine grained sediments and deposited under the high-low energy conditions of fluvatile and beach environments. The presence of abundant amounts of Quartz and SiO₂ in the bulk-rock samples also suggested fluvatile/beach environments. The inclusive graphic standard deviation diagrams and the size distribution data also indicated that fine-medium grained sediments, were deposited in the study areas. Occurrence of three groups of sediments for example, sediments from lower lagoon; sediments from upper lagoon and river; and the sediments from the dead-end marsh channels from the deeper parts of the basin of deposition, have been recognized. The kurtosis values indicated that studied sediments are composed of Platykurtic, Leptokurtic and Mesokurtic groups of sediments. The sandstones, present in the Bara formation of the Lakhra west and the east areas, showed the textural maturity, therefore, have been classified as sub-mature, and sub-mature to mature sandstones, respectively.

Keywords: sedimentation, cumulative curves, skewness, kurtosis, fluvatile, sphericity, textural maturity

Surface Properties of Water Soluble Surfactants, Starch and their Complexes by Various Methods

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(received 23 August, 2012; revised 5 July 2013; accepted 2 August, 2013)

Abstract. Surface, interfacial tensions and reduced viscosities were measured for water soluble surfactant and starch solutions in order to determine their potential as stabilisers, emulsifiers or cleansers. The surface tension and reduced viscosity for an acid hydrolysed starch (potato) initially were declined with concentration and then reached an equilibrium value of 56 mN/m and 3.1 dm³/mol, at 20-40 wt.%. Surface, interfacial tensions and reduced viscosity of starch with surfactant mixture using the ratio 40/60 decreased more rapidly with concentration reaching values of 41-44 mN/m, and 2.5 dm³/mol, respectively, at 40 wt.%. There was little dependence of surface or interfacial tensions on degree of substitution between 0.3-0.8 and amylose content of starch. Surface and interfacial tensions for starch /surfactants mixtures were lower than those for only starch, particularly at lower concentrations. Emulsions of soybean oil/water mixtures were successfully stabilised for >1 day by potato starch acetate/octenylsuccinate and acetate/ dodecylsuccinate but not by starch and surfactants. Therefore, these starches may represent biodegradable, economically alternatives to some emulsifiers, soap or detergents filler with effective cleansing activity and coating polymers currently in use.

Keywords: starch, surfactant, surface tension, viscosity, emulsifier, cleansing

Seasonal Variations in Dissolved Heavy Metals in Pompom River, Itakpe, Nigeria

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(received May 21, 2012; revised september 30, 2012; accepted October 23, 2012)

Abstract. Seasonal variations in dissolved heavy metals cadmium (Cd), copper (Cu), nickle (Ni), lead (Pb), and zinc (Zn) in Pompom river, flowing across Itakpe iron mine, Nigeria, was studied using flame atomic absorption spectroscopy (FAAS). Precision for the determination of heavy metals in water ranged 3-16 % and recovery studies gave 79-104 %. The average concentrations in the dry and rainy seasons for heavy metals in Pompom river were 0.03 ± 0.003 , 0.05 ± 0.002 , 0.01 ± 0.002 , 0.01 ± 0.001 and 0.04 ± 0.002 mg/L for Cd, Cu, Ni, Pb and Zn, respectively. Seasonal variation showed metallic levels in water to be higher during the rainy season than dry season. Cu, Ni, Pb and Zn metallic levels of the studied metals were within the values of Federal Environmental Protection Agency (FEPA) of Nigeria and WHO permissible guidelines for drinking water.

Keywords: mining, seasonal variations, heavy metals, river, monitoring

Effect of Repeated Laundering on Durability and Bactericidal Activity of Some Antibacterial Finishes

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(received November 29, 2012; revised January 23, 2013; accepted January 24, 2013)

Abstract. This paper investigates imparting antibacterial properties to a woven and a knitted cotton fabric using polyhexamethylene-biguanide hydrochloride (PHMB), silver salt and 5 chloro-2-(2,4-dichlorophenoxy) phenol based commercially available finishes. The antibacterial functions of the treated fabric samples are determined by the nature of the bacteria as well as number of repeated washing cycles. This research shows that these finishes are more effective against species of perspiration bacteria than *Escherichia coli*. A higher concentration of finishes is required to improve their effectiveness against *E. coli* and their durability to repeated laundering. The effect of antibacterial finishes on the tensile strength and burst strength of woven and knitted fabrics has also been investigated, respectively. The antibacterial finishes have no drastic effect on tensile strength and burst strength of the fabrics.

Keywords: antibacterial finish, *E. coli*, cotton, polyhexamethylene-biguanide hydrochloride, chlorinated phenoxy compound, silver salt

Investigation of Soil Fertility at a Remote Site in Karachi, Pakistan

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(received January 31, 2012; revised July 25, 2012; accepted September 25, 2012)

Abstract. This study reveals chemical and physical properties of soils collected from a remote site at Karachi, Pakistan. Altogether 23 parameters were determined. Out of 12 soil samples 11 were categorised as sand or sandy loams, pH varied between 7.35-8.49, density ranged between 1.61-2.39 gm/cm³, the conductivity of 1:2 water extracts varied up to a great extent i.e., between 0.437-16.47 mS/m³. Sodium (Na) contents were higher in ammonium acetate extract when compared with 1:2 water extract. The bicarbonate (HCO₃) contents were ranged between 0.17-1.73 ppm. The organic matter contents were low (0.81-2.21%); these soils were also deficient in their macronutrient contents. Specifically, the ranges of nitrogen (N), phosphorous (P), potassium (K), calcium (Ca), magnesium (Mg) and sulphur (S) were 0.04-1.16%, 0.25-15.99 ppm, 4.40-135.89 ppm, 0.001-0.199%, 0.001-0.019% and 0.01-0.143%, respectively. Heavy metals were determined in diethylene-triamine-pentaacetic acid (DTPA) extracts and the levels of iron (Fe), copper (Cu), manganese (Mn), and zinc (Zn) in these samples were 1.86-32.80 ppm, 1.68-7.69 ppm, 16.51-75.28 and 0.25-20.75 ppm, respectively. Toxic heavy metals, lead (Pb) and nickel (Ni) contents were also estimated and their concentration was found low ranging between 0.91-5.63 ppm and 0.32-1.26 ppm, respectively.

Keywords: macronutrients, micronutrients, organic matter, soil fertility, soil texture, toxic metals
